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State of Washington
Department of Ecology

MEMO TO: Mike Price - Bob Bottman

FROM: Ron Devitt

SUBJECT: Mill Creek, near Battleground - Clark County

REFERENCE: Memo from Bob Bottman 12-19-72 to Nelson, Gerry, Sharon and files

DATE: May 18, 1973

INTRODUCTION Two surveys were conducted on Mill Creek in Clark County to determine the existing water quality. Also an effort was made to characterize drainages originating from Manor Farms.

The first samples were collected on February 14, 1973. Intermittent light sprinkles fell during the survey, but runoff was minimal compared to the second survey. On 4-17, sprinkles fell throughout the survey. heavy rains fell around 1100 hours and 1300 hours. The increased runoff contributed significantly more coliform at several of the stations.

SAMPLING LOCATIONS Sampling sites were as indicated by Bob's map with the following exceptions: Station 4 was omitted, and Station 8 was moved south to the extension of 159th Street.

| Mill Creek Stations | Location |
|---|---|
| #1 | Highway 502 Bridge ½ mile east of Dollars Corner |
| #2 | Bridge 15 yds. south of Dollar's Corner |
| #3 | Bridge @ NE 199th Street |
| #3A | 5 yds. below Hooper Bridge between NE 199th Street and NE 179th Street (on Manor Farms). |
| #5 | 10 yds. below culvert [illegible] |
| #6 | On B. T. Pagel's property [illegible] yds. south of NE 179th Street (below [illegible] creek from Manor property). |
| #7 | Bridge @ 50th Ave. NE |
| #8 | Previous bridge on NE 159th Street was of 50th Ave. [illegible] |

| Drainage Ditch Station | Location |
|---|---|
| A | 10 yds. upstream from confluence with Mill Creek @ Wooden Bridge above #3A. |
| B | On Manor Farms property-culvert 20 yds. upstream from confluence with Mill Creek (between stations #5 and #6). |

| Salmon Creek Station | Location |
|---|---|
| Upstream | 15 yds. above confluence with Mill Creek off NE Salmon Creek Rd. |
| Downstream | @ 15001 NE Salmon Creek Rd. 30 yds. below confluence with Mill Creek. |

DISCUSSION OF DATA COLLECTED 2-14-73 (See Table I)

Stations #1 and #2 are similar in the majority of parameters sampled. There was some die off of coliform between stations, and the pH increased; solids decreased. There appeared to be a general improvement of the creek due to self-purification.

At Station #3 the velocity of the creek was reduced greatly. The substrate was mud. COD and turbidity increased. Dissolved oxygen was significantly lower than at Station #2. Duckweed was present and a floating scum was present downstream. The creek was an eyesore at this station (see picture).

Between Stations 3 and 3A, ditch A from Manor Farms enters Mill Creek. The coliform is significantly higher at 3A.

The ratio of fecal to fecal streptococci ($\frac{5000}{250} = 20$) do not indicate that the coliform are from cattle. The ratio, if associated with livestock would be less than .7. A ratio greater than 4.4 suggests that the contamination is of human origin. These results were not expected as residences with failing septic tanks etc. were not noticed. TSS and TNVS increase as do nutrients. Velocity is greater at 3A and depth is less than at 3; biological activity appears to have decreased and dissolved oxygen is consequently higher. The nitrate values are very high.

From Station 3A to Station 5, there is a general improvement in water quality excepting DO, TS and TNVS. These values are similar.

Between Stations 5 and 6, Ditch B from Manor Farms enters Mill Creek. Data indicate that there was no great change due to this influence.

Between Stations 6 and 7, there was an increase in COD. Other values were similar.

Between Stations 7 and 8 there appears to be an unidentified source of coliform, but fecal:fecal streptococci ratio (2700:280 = 9.6) is not indicative of livestock. There is thought to be an additional tributary entering Mill Creek between these stations. Since no effort has been made to walk the entire drainage, I am not sure, but the flow appears to be much greater at 8 than 7. Solids and nutrients increase at the downstream station. The dissolved oxygen increases due to increased turbulence and velocity. The substrate and gradient is also more conducive for aeration.

Salmon Creek was sampled above and below Mill Creek to demonstrat increased coliform values to Mill Creek.

The chart on page 4 of this publication is too illegible to be viewed online. To request a printed copy of this publication, please contact the Environmental Assessment Program at the Washington State Department of Ecology.

TABLE I - DATA COLLECTED 2-14-73

| Station No. | 1 | 2 | 3 | 3A | 5 | 6 | 7 | 8 | Salmon Cr. Upstream | Salmon Cr. Downstream |
|---|---|---|---|---|---|---|---|---|---|---|
| COD | 15 | 15 | 23 | 23 | 15 | 15 | 22 | 22 | | |
| BOD | <2 | <2 | <2 | 5 | 3 | 3 | 3 | 5 | | |
| pH | ***6.4 | 6.8 | ***6.2 | 6.7 | 6.8 | 6.9 | 6.9 | 6.9 | | |
| Turbidity (JTU) | 5 | 5 | 29 | 23 | 7 | 8 | 8 | 8 | | |
| $NO_3$-N (Filtered) | .41 | .40 | .17 | 1.24 | .76 | .69 | .70 | .89 | | |
| $NO_2$-N (Filtered) | .01 | .01 | .01 | .02 | .01 | .01 | .01 | .01 | | |
| T. Kjeldahl-N (Unfiltered) | .02 | .02 | .03 | .08 | .05 | .07 | .13 | .17 | | |
| $NH_3$-N (Unfiltered) | .01 | .01 | .01 | .05 | .04 | .05 | .09 | .12 | | |
| Total Solids | 63 | 53 | 148 | 126 | 135 | 148 | 146 | 229 | | |
| Total Non Vol. Solids | 18 | 5 | 80 | 64 | 76 | 85 | 106 | 159 | | |
| Total Suspended Solids | 6 | 2 | 10 | 55 | 11 | 10 | | 12 | | |
| Total Sus. Non Vol. Solids | 1 | 0 | 0 | 12 | 7 | 2 | | 4 | | |
| Total Coliform | *3000 | *1110 | *1500 | *20,000 | *3500 | *3800 | *3300 | *23,000 | 700 | *2400 |
| Fecal Coliform | 160 | <40 | <100 | 5,000 | 1100 | 900 | 800 | 2,700 | 100 | 440 |
| Streptococci | <40 | <40 | <100 | 250 | <100 | <100 | <100 | 280 | <40 | 60 |
| Dissolved $O_2$ | 12.4 | 12.1 | **4.7 | **7.9 | **7.5 | **7.2 | **7.3 | 9.4 | | |

* Water quality violation (Total coliform shall not exceed a median of 240 with less than 20% of samples exceeding 1000)

** Water quality violation (DO shall exceed 8 ppm)

*** Water quality violation (ph shall be between 6.5-8.5)

DISCUSSION OF DATA COLLECTED 4-17-73 (See Table II)

Stations 1 and 2 were similar in the parameters sampled. As on 2-14-73, there was a die off of total coliform downstream. The dissolved oxygen decreased.

Between Stations 2 and 3, oxygen concentrations continued to decrease. The pH was lowered as in the previous survey. Nutrients COD, Total Solids and conductivity increased.

Ditch A enters the Creek upstream of Station 3A. Because of the dissimilarity of the data comparing A to 3A, it would appear that the dilution by the creek compensated for the majority of effects of the ditch. As an example, compare the solids data from Station 3 to the solids data from A. They are very similar and do not explain the increase at 3A. The interpretation is also confused by additional runoff which would naturally enter the creek between Stations 3 and 3A. There are too many natural effects due to the heavy rains, natural drainage, and creek travel to contribute any direct effect of Ditch A. The high nitrate value of A and the increase at 3A does look suspiciously as though it may be coming from the Ditch A. The increase in nitrate was also observed during dry weather flow in February.

From Station 3A to Station 5 there is a decrease in COD, solids and coliform. But there is also a decrease in dissolved oxygen and an increase in nutrients excepting nitrate which is probably being removed by plant utilization.

Between Stations 5 and 6 Ditch B enters the creek. The short distance <50 yds. between the creek stations and high values (except DO) in the ditch leave little doubt that the effect on the creek is due to the ditch. The coliform are gross; the COD (225 ppm) is similar to some sewage treatment plant influents, and the BOD is also extremely high (51 ppm). The $NH_3$ concentration (1.04) is considered toxic to fish life (>1.0 ppm). Solids concentrations are also high. An unpleasant odor was present. Dissolved oxygen concentration was 1.6 ppm. All of the parameters discussed above are reflected by subsequent changes in water quality at Station 6.

The creek fails to recover completely, even downstream at Stations 7 and 8.

The chart on page 7 of this publication is too illegible to be viewed online. To request a printed copy of this publication, please contact the Environmental Assessment Program at the Washington State Department of Ecology.

TABLE II - DATA COLLECTED 4-17-73

| Station No. | 1 | 2 | 3 | Ditch A | 3A | 5 | Ditch B | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| COD | 27 | 27 | 31 | 39 | 54 | 31 | 225 | 62 | 58 | 50 |
| BOD | 3 | 3 | 3 | <8 | <16 | <8 | 51 | 13 | 13 | 10 |
| pH | 7.0 | 7.0 | 6.5 | 7.0 | 6.9 | 6.9 | 7.0 | 6.9 | 6.9 | 7.0 |
| Conductivity µmhos/cm | 76 | 67 | 100 | 170 | 160 | 150 | 380 | 180 | 180 | 190 |
| $NO_3$-N (filtered) | .13 | .11 | .07 | .98 | .27 | .25 | .03 | .25 | .36 | .54 |
| $NO_2$-N (filtered) | .01 | .01 | .01 | .02 | .01 | .03 | .01 | .03 | .04 | .04 |
| $NH_3$-N (unfiltered) | .01 | .01 | .02 | .04 | .01 | .04 | 1.04 | .18 | .14 | .12 |
| T. Kjeldahl-N (") | .03 | .03 | .04 | .06 | .04 | .06 | 1.16 | .22 | .17 | .15 |
| O-$PO_4$-P (filtered) | .02 | .02 | .06 | .02 | .08 | .48 | .02 | .44 | .42 | .22 |
| Total Solids | 75 | 122 | 144 | 143 | 218 | 111 | 346 | 150 | 159 | 142 |
| Total Non Vol. Solids | 43 | 80 | 89 | 73 | 97 | 43 | 152 | 56 | 75 | 70 |
| Total Suspended " | 18 | 12 | 12 | 14 | 14 | 8 | 77 | 22 | 34 | 10 |
| Total Non Vol." " | 6 | 5 | 4 | 8 | 8 | 4 | 28 | 8 | 24 | 1 |
| Total Coliform | *7,000 | *2,500 | *3,000 | *3,000 | *1,400 | *900 | *300,000 | *200,000 | *100,000 | *130,000 |
| Fecal Coliform | 700 | 600 | 300 | 300 | 300 | 300 | 180,000 | 15,000 | 25,000 | 35,000 |
| Fecal Streptococci | 500 | 600 | 500 | 350 | 350 | 280 | >20,000 | >5,400 | >4,200 | >4,000 |
| FC:FS | 1.4 | 1.0 | .6 | .86 | .86 | 1.1 | NC | NC | NC | NC |
| T (C°) | 10. | 10.5 | 10.5 | - | 11. | 11. | 11. | 11. | 11. | 11. |
| DO ppm | 11.25 | 10.0 | **6.15 | 8.95 | 8.75 | **5.53 | **1.6 | **5.0 | **4.9 | **6.7 |
| DO% SAT | 99 | 90 | 55 | NC | 79 | 50 | 14 | 45 | 44 | 60 |

* Water quality violation (total coliform shall not exceed a median of 240 with less than 20% of samples exceeding 1,000)

** Water quality violation (DO shall exceed 8 ppm)

NC Not computed

SELECTED WATER QUALITY CRITERIA OF CLASS A WATER[1]

Total coliform shall not exceed median values of 240 with less than 20% of the samples exceeding 1,000 when associated with any fecal source.

Dissolved Oxygen shall exceed 8.0 mg/l.

pH shall be within the range of 6.5 to 8.5 . . .

Aesthetic values shall not be impaired by the presence of materials . . . which offend the sense of sigh, smell, touch or taste.

The Department also considers the values listed below as critical levels for nutrients:

| Substance | Critcal level mg/l | Significance |
|---|---|---|
| Nitrate ($NO_3$-N) | .3 | Algal bloom potential |
| Nitrite ($NO_2$-N) | .02 | Organic pollution |
| Ammonia ($NH_3$-N) | .2 | Organic pollution |
| Ammonia ($NH_3$-N | 1.0 | Unattractive for fish - toxic |
| Ortho phosphate ($O\text{-}PO_4\text{-}P$) | .01 | Algae bloom potential |

Water quality criteria violations and critical levels of $NH_3$, $NO_2$, $NO_4$ and $O\text{-}PO_4$ are listed on Table III. Violations are indicated by "0"; acceptable conditions are indicated by +.

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[1]Implementation and Enforcement Plan for Water Quality Regulations Department of Ecology, Sept. 1970, p. 8.

TABLE III - MILL CREEK 2-14-73

| Stations | 1 | 2 | 3 | 3A | 5 | 6 | 7 | 8 | Salmon Cr. | Salmon Cr. |
|---|---|---|---|---|---|---|---|---|---|---|
| Total Coliform | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | + | 0 |
| Dissolved $O_2$ | + | + | 0 | 0 | 0 | 0 | 0 | + | - | - |
| pH | 0 | + | 0 | + | + | + | + | + | - | - |
| $NO_3$-N | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | - |
| $NO_2$-N | + | + | + | + | + | + | + | + | - | - |
| $NH_3$-N | + | + | + | + | + | + | + | + | - | - |

0 = Unacceptable
+ = Acceptable
- = Not Sampled

MILL CREEK 4-17-73

| Stations | 1 | 2 | 3 | A | 3A | 5 | B | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| Total Coliform | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dissolved $O_2$ | + | + | 0 | - | + | 0 | 0 | 0 | 0 | 0 |
| pH | + | + | + | + | + | + | + | + | + | + |
| $NO_3$-N | + | + | + | 0 | + | + | + | 0 | 0 | |
| $NO_2$-N | + | + | + | + | + | 0 | + | 0 | 0 | 0 |
| $NH_3$-N | + | + | + | + | + | + | 0 | + | + | + |
| $O\text{-}OP_4$-P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

0 = Unacceptable
+ = Acceptable
- = Not Sampled

## SUMMARY

Mill Creek as sampled on 2-14-73 was in violation of the following water quality criteria:

1. Total coliform - Stations 1-8
2. Dissolved $O_2$ - Stations 3-7
3. pH - Stations 1 and 3

Nitrate levels exceed that necessary for algae bloom potential.

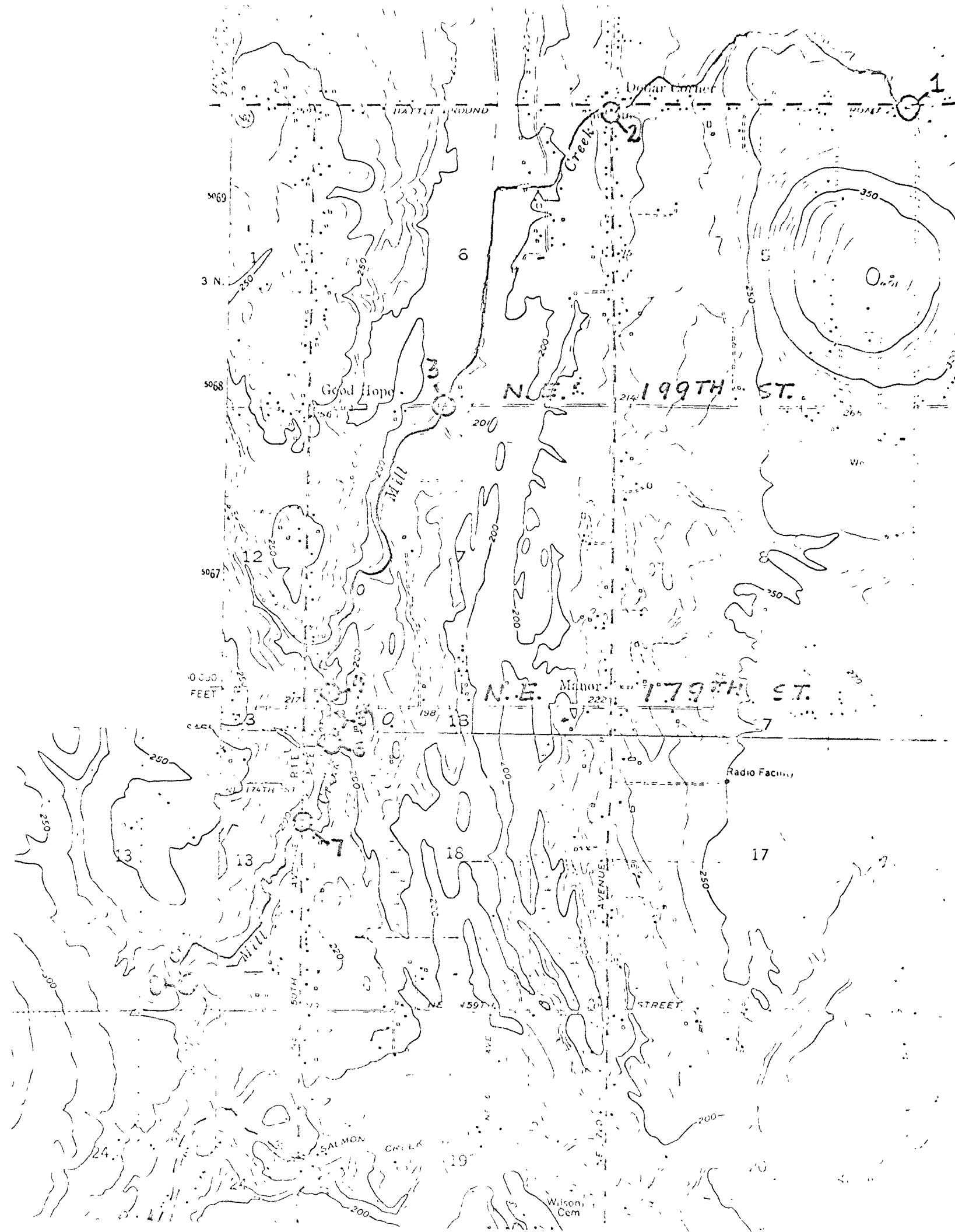
On 4-17-73 Mill Creek was in violation of the following water quality criteria.

1. Total coliform - Stations 1-8
2. Dissolved oxygen - Stations 1 and 5-8

## CONCLUSIONS

Excessive total coliform, low dissolved oxygen and occasional low pH values exist throughout the drainage system.

During heavy rains the drainage ditch B becomes grossly contaminated and effects Mill Creek for considerable distance downstream.


Dollar Corner
BATTLE GROUND
Creek
Good Hope
N.E. 199TH ST.
Mill
N.E. Manor
N.E. 179TH ST.
Radio Facility
AVENUE
STREET
SALMON
CREEK
Wilson
Cem
3 N.
FEET